

M9A GPIB OPTION

INSTRUCTION MANUAL

MP MASTER



MA25464

M9A POWER SUPPLY GPIB CARD

GPIB OPERATION

Interface Functions

The following interface functions, defined by IEEE standard 488 are implemented:

SH1	Source Handshake
AH1	Acceptor Handshake
T6	Talker
L4	Listener
SR1	Service Request
RL1	Remote Local
PP1	Parallel Poll
DC1	Device Clear
DT1	Device Trigger
E1	Open Collector Drivers

Multiline Control Functions

The Acceptor Handshake, Source Handshake, Listener, and Talker functions are implemented by the interface card and the controller and require no action by the user. The ADR indicator on the rear panel turns on when the power supply is addressed to listen or talk. (The talker function includes serial poll)

Service Request

Service request is a uniline message asserted by the power supply at power on and for fault conditions. Six power supply conditions are defined as faults. Enabling or disabling a condition from asserting service request does not affect the condition within the power supply, nor the external status indicators.

Serial Poll

In a serial, the controller polls each device. The power supply responds with an 8 bit status byte defined as follows:



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<u>DIO Line</u>	<u>Decimal Weight</u>	<u>Description</u>	<u>Reset By</u>
1	1	Fault - set when any bit in fault register is set.	Fault? Query
2	2	N/A	
3	4	N/A	
4	8	N/A	
5	16	Ready - set when power supply is ready to accept commands	When power supply is busy processing a command
6	32	Error - set when ERR bit asserted in status register	ERR? Query
7	64	Request Service - set when power supply requests service.	Serial Poll
8	128	Power on - set when unit initializes at power on.	CLR or Device Clear

Parallel Poll

Parallel poll allows the controller to determine quickly which of a number of instruments on the bus requested service. The parallel poll response corresponds to bit #7 of a serial poll status byte. Parallel poll does not reset the service request. The power supply must be configured remotely to respond to a parallel poll with either a "1" or "0" on one of the DIO lines if the unit is requesting service.

Remote/Local

The remote/local function allows the power supply to operate in either local or remote (IEEE 488) control. The power supply may be switched from REM to LOC and back to REM without loss of the programmed values. The user can send a Local Lockout to the power supply via the IEEE 488 bus to disable the remote switch on the rear panel. With Local Lockout, the controller determines if the unit

operates in local or remote mode. This enables the controller to prevent anyone from returning the power supply to local control.

Device Clear

The power supply will implement Device Clear regardless of whether the unit is in local or remote control. Device Clear is typically used to send all or selected devices to a known state with a single command. The power supply will be set to Initial Conditions after Device Clear.

Device Trigger

Device Trigger will enable the most recently programmed values whether the unit is in local or remote control. If the power supply is in local mode, the new values will be implemented when switched from local to remote control. Device Trigger is typically used to synchronize the operation of a number of addressed devices.

Address Selection

The GPIB address switches are located on the rear panel. The GPIB address is set in binary, with A1 the least significant bit and A5 the most significant bit. Any address from 0 to 30 decimal is a valid GPIB address. The power supply address is the total value of switches selected. Address 31 will cause a self-test error

The switches on the rear panel are as follows:

<u>Function</u>	<u>Address Value</u>		<u>Switch</u>
	<u>Open Left</u>	<u>Closed Right</u>	
A5	0	16	8 (top)
A4	0	8	7
A3	0	4	6
A2	0	2	5
A1	0	1	4
NOT USED	-	-	3
PON SRQ	ON	OFF	2
REMOTE	ON	OFF	1 (bottom)

Power-On Service Request

The power supply will request service from the controller when power is turned on and the rear-panel PON SRQ switch is set.

If enabled, PON SRQ will request service when the power supply is turned on or any time a momentary input power dropout causes the power supply to re-initialize.

The power supply initializes at power on with the following programmed values:

Initial Conditions (Remote enabled)

Voltage	0 Volts	(VSET 0)
Current	0 Amps	(ISET 0)
OVP Trip Voltage	Model VMAX+10%	(OVSET 33) i.e. 30V Model
Soft Voltage Limit	Model VMAX	(VMAX 30) i.e. 30V Model
Soft Current Limit	Model IMAX	(IMAX 10) i.e. 10A Model
Dealy	0.5 second	(DLY 0.5s)
Foldback Protection	off	(FOLD OFF)
Output	On	(OUT ON)
Unmask	None	(UNMASK NONE)
Hold	Off	(HOLD OFF)

Syntax

Numbers can be sent to the power supply with implicit or explicit decimal point or with scientific notation.

All numeric data fields may contain an optional plus or minus sign on both the number itself and the exponent.

All numeric data fields may contain leading spaces, and embedded spaces between signs and digits, digits and E, decimal point and E, and E and sign.

Embedded spaces will not be accepted between digits or between digits and decimal point.

At least one digit must precede E. Lower case e is treated the same as upper case E.

Separators are used by the power supply to break up commands.

The explicit separators are commas and spaces. An explicit separator is required between a command and its

parameter. For example, OUT ON is correct, OUTON is not correct. Commas are used only to separate parameters in commands containing more than one parameter. MASK and UNMASK are the only commands for which more than one parameter may be sent. Only one comma is allowed, and it may be preceded or followed by any number of spaces.

Spaces are used in all other cases requiring explicit separators. Any number of consecutive spaces is treated as one space.

Terminators mark the end of a command string, and instruct the power supply that the command should be executed. The terminator characters are the line feed and semicolon.

Line feed is sent by most controllers automatically after OUTPUT statements unless suppressed. If more than one command per line is sent, the commands must be separated by semicolons.

A terminator may be preceded or followed by any number of spaces.

The carriage return character by itself is not sufficient to terminate a command.

Commands may also be terminated by asserting EOI on the GPIB concurrently with the last byte of the command.

All data returned to the controller are terminated by a carriage return and a linefeed character. EOI is asserted concurrently with linefeed.

DEVICE DEPENDENT COMMAND DESCRIPTIONS

VSET X	- programs the output voltage from 0 to
VSET -X	VMAX in volts or millivolts. A negative
VSET XV	voltage value sets the Polarity line
VSET XmV	J7-2.
ISSET X	- programs the current limit from 0 to
ISSET XA	IMAX in amps or milliamps.
ISSET XmA	
VSET?	- queries voltage/current settings
ISSET?	returns VSET xxx.xxx or (VSET - xxx.xxx)
	ISSET xxx.xxx
VOUT?	- queries voltage/current output readback
IOUT?	returns VOUT xxx.xxx
	IOUT xxx.xxx
VMAX x	- sets upper soft limit for voltage and
IMAX x	current programming values
VMAX?	- queries voltage/current soft limit setting
IMAX?	returns VMAX xxx.xxx
	IMAX xxx.xxx
OVSET x	- programs the OVP trip level
	(x = 0 to 110% VMAX)
OVSET?	- queries the OVP setting
	returns OVSET xxx.xxx
DLY x	- disables CV, CC and FOLD during delay time
DLY xs	delay timing is initiated after execution
	of VSET, ISET, RST and OUT ON commands.
DLY xms	(x = 0 to 32 sec, 32 ms resolution)
DLY?	- queries delay time setting
	returns DLY xx.xxx
OUT ON	- turns power supply output ON/OFF
OUT 1	OUT OFF also sets the Isolation line J7-3
OUT OFF	
OUT 0	
OUT?	- queries output ON/OFF setting
	returns OUT 0 or OUT 1
FOLD CV	- enables or disables foldback protection,
FOLD 1	which will disable the supply when the
FOLD CC	output enters the fold condition.
FOLD 2	(FOLD OFF during delay time)

FOLD OFF

FOLD 0

FOLD? - queries Foldback setting
returns FOLD 0, FOLD 1 or FOLD 2

HOLD OFF

HOLD 0

HOLD ON

HOLD 1

- holds or implements newly received commands. Used to synchronize devices on the bus. Held values are implemented by TRG or device trigger commands

HOLD?

- queries HOLD setting
returns HOLD 0 OR HOLD 1

T

TRG

- implements held commands

RST

- resets supply if output is disabled by OVP or foldback protection.

UNMASK x

UNMASK mnem

- enables bit setting in the MASK register

MASK x

MASK mnem

- disables bit setting in the MASK register

(x = 0 to 255)

(mnem = CV, CC, OV, SD, FOLD, ERR, NONE, ALL,)

UNMASK?

- queries enabled bits in the MASK register
returns UNMASK xxx

STS?

- queries the current status register
returns STS xxx

ASTS?

- queries the accumulated status register. (ASTS = STS after query)
returns ASTS XXX

FAULT

- queries the FAULT register. A bit in the fault register is set when the corresponding status register bit changes from inactive to active and the corresponding mask register bit is enabled. Fault register clears after a query. Fault query also clears FAULT bit in serial poll register. When a bit is set in the FAULT register, the fault control line J7-4 is asserted. It is cleared when the fault register is cleared.
returns FAULT XXX

- SRQ OFF - enables or disables service request.
 SRQ 0 service request is also disabled while the
 FAULT bit is set in the serial poll
 register.
- SRQ ON
 SRQ 1
- SRQ? - queries SRQ setting
 returns SRQ 0 OR SRQ 1
- CLR - initializes supply to power-on state and
 resets PON bit in serial Poll register.
- ERR? - determines programming error. (Error
 value valid only while ERR LED on rear
 panel is lit - error value is reset by
 correct command) clears ERROR bit in
 serial poll register.
 returns ERR X (see Error Codes)
- ID? - reports power supply model and software
 version
 returns ID model # version X.XX

<u>Model #</u>	<u>VMAX</u>	<u>IMAX</u>
HPD 15-20	15	20
HPD 30-10	30	10
HPD 60-5	60	5
XT 7-6	7	6
XT 15-4	15	4
XT 20-3	20	3
XT 30-2	30	2
XT 60-1	60	1
XT 120-0.5	120	0.5

ERROR CODES

Error

- | | |
|---|--|
| 0 | No Errors |
| 1 | Unrecognized Character - A character like "!" was received. |
| 2 | Improper Number - A numeric character (+ -.0...9) was received but the characters did not represent a proper number. |
| 3 | Unrecognized String - An invalid command was received. |
| 4 | Syntax Error - A word, number, terminator, or separator was incorrectly placed. |
| 5 | Number Out of Range - A number was received that is too large for the command with which it was received. |
| 6 | Attempt to Exceed Soft Limits - An attempt was made to program a voltage or current greater than the soft limit. |
| 7 | Improper Soft Limit - An attempt was made to program a soft limit less than the output value. |
| 8 | Data Requested Without A Query Being Sent |
| 9 | OVP set below output |

STS, ASTS, MASK and FAULT registers

	<u>ERR</u>	<u>FOLD</u>	<u>S/D</u>	-	<u>OV</u>	-	<u>CC</u>	<u>CV</u>
Weight	128	64	32	16	8	4	2	1
D10 Line	8	7	6	5	4	3	2	1

ERR - remote programming error

FOLD - foldback protection tripped

S/D - external shutdown (J7-1, J7-5)

OV - OVP tripped

CC - Constant current mode

CV - Constant voltage mode

Status Register

The status register provides the present state of the supply. Each bit above represents a specific condition when the bit is set to 1. Bits remain set as long as the conditions are true.

Accumulated Status Register

The accumulated status register records all status changes since the ASTS was last read. All temporary condition changes that may be difficult to observe with STS? query can be viewed in the ASTS. The ASTS is set to the STS value after it is read.

Mask and Fault Registers

The user maintained MASK register specifies which bits in the STS register can set bits in the FAULT register. A bit is set in the FAULT register when the corresponding bit changes from 0 to 1 in the STS register and the corresponding bit is set to 1 in the MASK register. The FAULT bit in the serial poll register is set to 1 when a bit is set in the FAULT register.

Example - Enable Service Request for OVP Condition

UNMASK OVP

SRQ ON

(OVP fires, SRQ generated)

FAULT? (returns FAULT 8)

STS? (returns STS 10, OVP and CC set)

ASTS? *(returns ASTS 11, OVP, CC and CV set)

ASTS? (returns ASTS 10)

RST (OVP reset)

STS? (returns STS 1)

* ASTS indicates that the power supply was in CV mode, CC mode and OVP fired since the last ASTS? query.

J7 Detail (Rear Panel 6 Pos Jack)

J7-1 - external TTL S/D
2 - *Polarity signal (-Ve VSET)
3 - *Isolation signal (OUT OFF)
4 - *Fault signal
5 - external VCC
6 - external GND and S/D return

* open collector outputs

S2 Detail (Internal Switch)

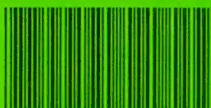
<u>Function</u>	<u>Open</u>	<u>Closed</u>	<u>Switch</u>
A1 (SEC,ADR)	1	0	1
A2	2	0	2
A3	4	0	3
A4	8	0	4
A5	16	0	5
SERIES SELECT	HPD	XT	6
PROGRAM OVP	OFF	ON	7
LOCAL OVP	OFF	ON	8

Secondary address 31 disables secondary addressing. Only one of switch 7 or 8 should be closed for proper OVP operation.

M9A Specifications (25 $\pm$ 5 C)

	<u>Program Resolution</u>	<u>Program Accuracy</u>	<u>Readback Resolution</u>	<u>Readback Accuracy</u>
Voltage	$\pm$ 0.03%	$\pm$ 0.05%	$\pm$ 0.03%	$\pm$ 0.05%
Current	$\pm$ 0.03%	$\pm$ 0.05%	$\pm$ 0.03%	$\pm$ 0.05%
OVP	$\pm$ 0.05%	$\pm$ 0.05%	N/A	N/A

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